PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-315819
(43)Date of publication of application : 29.11.1996

(51)Int.CI. H01M 4/58 H01M 4/02 H01M 10/40

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CLAIMS

[Claim(s)]

[Claim 1] The secondary battery that use a positive active material expressed by $Li_aNi_bM^1_cM^2_dM^3_eO_2$ (wherein, M^1 is at least one sort of elements chosen out of Co, Mn, and Fe, M^2 is at least one sorts of elements chosen out of B, Al, In, and Sn, and M^3 is at least one sort of elements chosen out of Mg, Zn.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0009] [The purpose of this invention]

To offer the long lasting lithium secondary battery which has an excellent rate capability.

[0021] (Example 1- coin cell A1)

- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$, B_2O_3, and MgO were used.
- The mole ratio, Li : Ni : Co : B : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0 .01.
- The mixture was calcinated at 750 degrees C under oxygen atmosphere for 20 hours. After calcination, it was cooled in dry air, and was milled.
- Cathode : Acetylene black : PTFE = 85 :10 : 5
- Positive electrode is dried at 200 degree C in vacuum.
- Counter electrode is Li metal.
- Electrolyte is EC/DEC (1:1 vol%)

A03

[0024] (Example 2 - coin cell A2)

- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$, $Al_2(NO_3)_3$, and MgO were used.
- The mole ratio, Li : Ni : Co : Al : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0 .01.

[0025] (Example 3 - coin cell A3)

- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$, $In(NO_3)_3 \cdot xH_2O$ and MgO were used.
- The mole ratio, Li : Ni : Co : In : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0 .01.

[0026] (Example 4 - coin cell A4)

- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$, SnO and MgO were used.
- The mole ratio, Li : Ni : Co : Sn : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0 .01.

[0027] (Example 5 - coin cell A5)

- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$, B_2O_3, and ZnO were used.
- The mole ratio, Li : Ni : Co : B : Zn is 1.03 : 0.88 : 0.10 : 0.01 : 0 .01.

[0028] (Example 1 of a comparison – coin cell B1)

- $LiOH \cdot H_2O$, Ni_2CO_3 were used.
- The mole ratio, Li : Ni is 1.03 : 1.00.

[0029] (Example 2 of a comparison – coin cell B2)

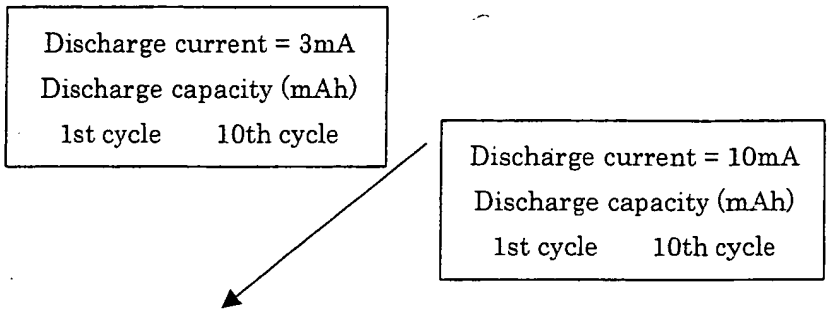
- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$ were used.
- The mole ratio, Li : Ni : Co is 1.03 : 0.90 : 0.10.

[0030] (Example 3 of a comparison – coin cell B3)

- $LiOH \cdot H_2O$, Ni_2CO_3, B_2O_3 were used.
- The mole ratio, Li : Ni : B is 1.03 : 0.90 : 0.10.

[0031] (Example 4 of a comparison – coin cell B4)

- $LiOH \cdot H_2O$, Ni_2CO_3, $CoCO_3$, B_2O_3 were used.
- The mole ratio, Li : Ni : Co : B is 1.03 : 0.89 : 0.10 : 0.01



[0034]

[Table 1]

電池	放電電流 3mA 放電容量(mAh) 1サイクル	10サイクル	放電電流 10mA 放電容量(mAh) 1サイクル	10サイクル
A1	65	64	58	55
A2	66	63	57	54
A3	65	64	57	55
A4	66	64	56	53
A5	66	63	55	52
B1	52	45	28	25
B2	50	43	29	24
B3	49	40	30	25
B4	63	62	30	28

[0035] As shown in Table 1, the cells A1, A2, A3, A4 and A5 by this invention had a large initial discharge capacity compared with the comparison cell B1, B2, and B3. Furthermore, the cells A1, A2, A3, A4 and A5 by this invention had a good rate capability compared with the cell B4.